

**What is claimed is:**

1           1.       A control system for supplying a fuel to a fuel cell stack that includes an anode  
2   and a cathode and generates electrical energy by a chemical reaction of the fuel, comprising:  
3           a fuel storage unit that stores the fuel to be supplied to the fuel cell stack;  
4           a diluent storage unit that stores a diluent that is a byproduct of the chemical reaction in  
5   the fuel cell stack;  
6           a sensor that detects a concentration of a fuel in a fuel mixture solution and outputs a  
7   signal according to the concentration; and  
8           a control unit that receives the signal from the sensor and controls the fuel mixture  
9   solution.

1           2.       The control system of claim 1, wherein the sensor has a portion that varies  
2   volume thereof depending on the concentration of the fuel

1           3.       The control system of claim 1, further comprising:  
2           a fuel mixing unit that mixes the fuel supplied from the fuel storage unit and the diluent  
3   supplied from the diluent storage unit.

1           4.       The control system of claim 3, wherein the sensor is located in the fuel mixing  
2   unit.

1           5.       The control system of claim 4, wherein the sensor detects the fuel concentration  
2   using characteristics that volumes of the sensor change depending on the fuel concentration.

1           6.       The control system of claim 1, further comprising:  
2           a line between the fuel storage unit and the diluent storage unit,  
3           wherein the line supplies the fuel mixture.

1           7.       The control system of claim 6, wherein the sensor is located in the line.

1           8.       The control system of claim 7, wherein the sensor detects the fuel concentration  
2           using characteristics that volumes of the sensor change depending on the fuel concentration.

1           9.       The control system of claim 1, wherein the sensor comprises:  
2           a substrate; and  
3           a sensor film attached to a surface of the substrate,  
4           wherein the sensor film changes volume thereof depending on the concentration of the  
5           fuel in the fuel mixture solution.

1           10.      The control system of claim 1, wherein the sensor comprises:  
2           an external electrode;  
3           an internal electrode; and  
4           a sensor member that fills the space between the internal electrode and the external  
5           electrode, wherein the sensor member changes volume thereof depending on the concentration of  
6           the fuel mixture solution.

1           11.      The control system of claim 9, wherein the sensor is manufactured using  
2           polymeric ion exchange membrane or resin.

1           12.     The control system of claim 10, wherein the sensor is manufactured using  
2     polymeric ion exchange membrane or resin.

1           13.     The control system of claim 9, wherein the sensor comprises an electronic circuit  
2     that outputs an electrical signal depending on a change in the volume of the sensor.

1           14.     The control system of claim 10, wherein the sensor comprises an electronic circuit  
2     that outputs an electrical signal depending on a change in the volume of the pressure sensor.

1           15.     The control system of claim 11, wherein the polymeric ion exchange membrane  
2     or resin is one OF polystyrene sulfonic acid, poly ether ether sulfone sulfonic acid, sulfonated  
3     polyolefin and sulfonated polysulfane.

1           16.     The control system of claim 12, wherein the polymeric ion exchange membrane  
2     or resin is one of polystyrene sulfonic acid, poly ether ether sulfone sulfonic acid, sulfonated  
3     polyolefin and sulfonated polysulfane.

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1           17.     A sensor for a fuel concentration in a fuel cell, comprising:  
2                   a substrate; and  
3                   a sensor film on the substrate,  
4                   wherein the sensor film changes volume thereof depending on a concentration of  
5                   fuel in fuel mixture.

1           18.     The sensor of claim 17, wherein the sensor film is made of polymeric ion  
2     exchange membrane or resin.

1           19.     The sensor of claim 17, wherein the polymeric ion exchange membrane or resin is  
2     one of polystyrene sulfonic acid, poly ether ether sulfone sulfonic acid, sulfonated ployolefin and  
3     sulfonated polysulfone.

1           20.     A sensor for a fuel concentration in a fuel cell comprising:  
2                 an external electrode;  
3                 an internal electrode; and  
4                 a sensor member that fills the space between the internal electrode and the  
5                 external electrode,  
6                 wherein the sensor member changes volume thereof depending on a concentration  
7     of fuel in fuel mixture.